THE WEATHER AND CIRCULATION OF DECEMBER 1952[1]

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THE BROAD SCALE CIRCULATION PATTERN

The monthly mean contours at 700 mb. for December 1952 (fig. 1) indicate that the important North American features included: a low latitude trough off the Californias, ridge conditions from Utah northward through Alberta, and a weak trough extending northeastward from Arkansas to western Quebec and then northwestward. Although heights over the United States were not far from normal, adjacent areas, especially the Gulf of Alaska, Canada, and southern Greenland, had more significant departures. A vigorous Gulf of Alaska Low was accompanied by heights

[1] See charts I to XV following page 255 for analyzed climatological data for the month.

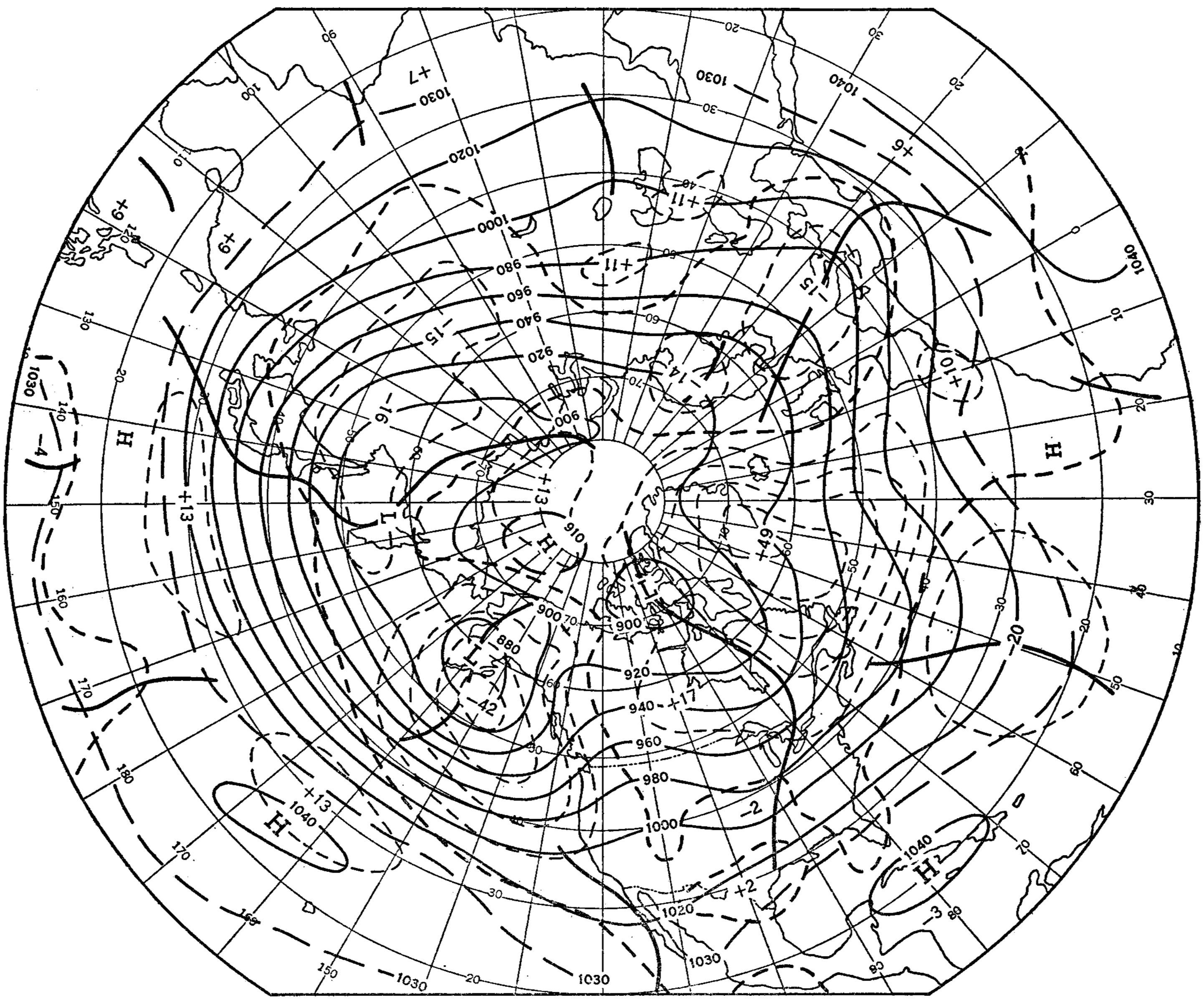

FIGURE 1.—Mean 700-mb. height contours and departures from normal (both labeled in tens of feet) for November 29–December 28, 1952. Note unusual intensity of Gulf of Alaska Low and continued (from November) blocking over North Atlantic.

420 ft. below normal at 700 mb. and pressure 16 mb. below normal at sea level (chart XI inset). Fronts and cyclones emanating from this center of action repeatedly traversed Canada and the northern United States (chart X). The sea level mean map for the month (chart XI) shows the effects of this activity of maritime origin in the presence of a zonal trough across central Canada and in the lack of the more customary extension of polar high pressure southward. As a result sea-level pressures averaged well below normal across all of Canada except the eastern quarter.

Coupled with the Pacific abnormality was a positive departure of 490 ft. at 700 mb. (+15 mb. at sea level) over southern Greenland. The continued presence of above normal heights and pressures across the northern Atlantic since their inception there in early November [1] has been a dominant characteristic of the season. As a consequence the Atlantic westerlies were much weaker than normal again, and blocking activity was once more prevalent. The strong low latitude trough east of Bermuda (fig. 1) is a frequent counterpart to such activity.

Since it is difficult to determine direct cause and effect relationships between circulation features so widely separated as the Gulf of Alaska and Greenland, it is of interest to note that the general pressure distribution of this December is not uncommon. This is shown by figure 2, a composite map made by averaging the ten 5-day mean 700-mb. maps (in 5 winters of data) which had the largest negative height departures centered in the Gulf of Alaska (more exactly, 50° N., 150°–160° W.). This map was prepared by D. Martin in the course of an investigation which seeks to identify the hemispheric interrelationships of strong circulation features [2]. In this case, the general correspondence of wave pattern and height anomaly features between figures 1 and 2 would tend to indicate that the association between negative anomalies in the Gulf of Alaska and positive anomalies in Greenland and the northern Atlantic is not fortuitous. This association is, perhaps, more evident in the temperature field where above normal warmth affected most of Canada and Greenland.

The monthly mean thickness departure from normal (between 1000 and 700 mb.), figure 3, shows the intensity and distribution of these unusually warm conditions. The western sections of this anomaly probably resulted from a strong influx of maritime air from the Gulf of Alaska Low. The vast extension of warm air eastward to Greenland is readily associated with the sea level pressure departures from normal (chart XI inset). Abnormally strong southerly components of flow (relative to normal) are indicated from Greenland through western Canada. These suggest that maritime Atlantic air, in conjunction with the high latitude block, augmented the effects of the strong influx of mild Pacific air.

An additional aspect of the broad scale circulation is shown in figure 4, the average 200-mb. contours and isotachs for the same period as figure 1. The general characteristics of the circulation at 200 mb. were quite similar to those at the 700-mb. level. An intense jet over southern Japan, a familiar winter phenomenon in the area [3], gradually weakened as it crossed the Pacific. The axis of the mean jet reached fairly low latitudes (25° N.) in the eastern Pacific trough and then swung northeastward through the northern Gulf States. A center of maximum wind speed was located near the western Atlantic trough, but it was displaced south of its normal position, a symptom of blocking in the Atlantic. The poorly defined central and eastern Atlantic jet and the secondary minor wind-speed maxima at middle and higher latitudes, were additional tokens of the Atlantic block. Particularly striking is the contrast in wind speed between the 72 m. p. s. jet maximum in the Pacific and the 41 m. p. s. maximum in the Atlantic; this ratio is normally about 4 to 3.

SURFACE WEATHER RELATED TO MEAN CIRCULATION

As might be anticipated from the thickness anomaly,

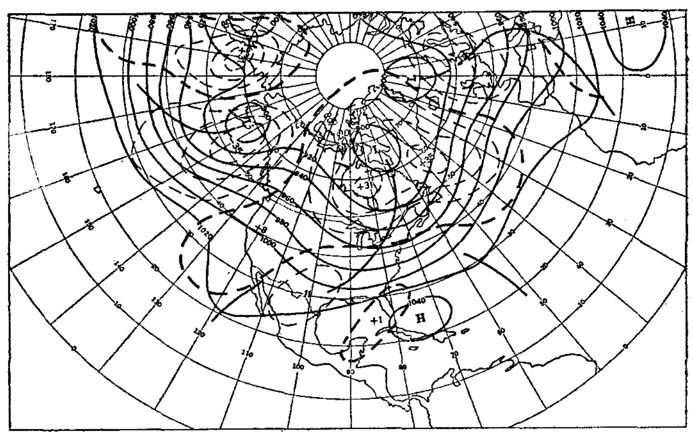

FIGURE 2.—Mean 700-mb. height contours and departures from normal (both labeled in tens of feet) for the ten 5-day mean 700-mb. charts in winter which had maximum negative height departures centered in the Gulf of Alaska. Note similarity of features and phase to figure 1, especially the strong center of above normal heights over Greenland common to both maps.

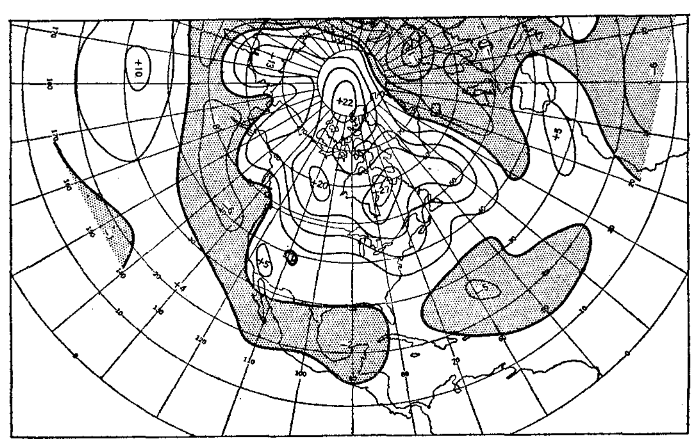

FIGURE 3.—Mean departure from normal of thickness (1000–700 mb.) for November 29–December 28, 1952, analyzed for intervals of 50 ft. with centers labeled in tens of feet. Above normal thicknesses covered most of North America, and centers of +270 and +200 feet occurred in Canada, corresponding to mean virtual temperatures about 9° and 7° C. above normal.

figure 3, surface temperatures over the United States were relatively mild (see chart I–B). The northern States had the greatest positive anomalies with +8° F. in North Dakota and Sault Ste. Marie, Mich. The only two areas significantly below normal (about 2° F.) were part of the Central Plains and the extreme Southeast. This general temperature regime is typical of a winter month during which the normally cold air of the Canadian source region is greatly modified. Thus, air masses entering the United States from Canada were not cold enough to produce below normal average temperature except in the lowest latitudes where normals are the highest. In addition, the general flat westerly circulation (fig. 1), with only a weak western Canadian ridge, was not the type associated with frequent and rapid production of cold Highs over British Columbia or the Yukon, nor was it apt to produce rapid southeastward translation if any cold Highs were to form.

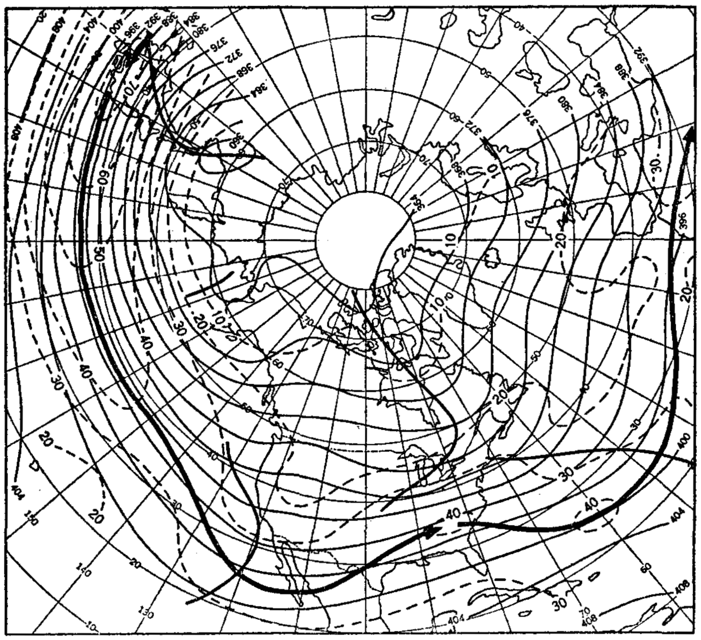

FIGURE 4.—Mean 200-mb. contours and isotachs November 29–December 28, 1952. Solid arrow indicates average "jet" which reached a value of 155 to 160 m. p. h. over southern Japan. Atlantic "jet" is farther south and weaker than normal in conjunction with blocking activity.

Further illustration of this condition is provided by figure 5 which shows the geographical distribution of anticyclonic passages. One maximum, over the eastern Great Basin, was mostly a result of Pacific pressure surges which often accompany prolonged cyclonic activity in the Gulf of Alaska. Another maximum, in the southern Mississippi Valley, was associated with eastward moving high pressure areas which were usually a combination of surges, the major contribution coming from the Great Basin, a minor one from Canada. This sequence occasionally involved the splitting of one high-pressure area into two anticyclones, one in the South Central United States, the other in New England. These anticyclones were generally composed of modified maritime polar air masses and were seldom cold through deep layers.

As illustrated in figure 6, cyclonic activity was quite frequent and intense in the Gulf of Alaska. Very few of these Lows managed to cross the mountains of western North America, but the associated upper-level perturbations and fronts traversed the mountains and produced many of the cyclones in western Canada. The major cyclonic activity affecting the United States occurred in two well-defined tracks: 1. from the Panhandle region northeastward through the central Great Lakes area, and 2. along the East Coast from off Florida to south of Nova Scotia. The former track was associated with the central United States trough, and many of the Lows appeared as secondary disturbances forming on trailing fronts of Canadian cyclones. In somewhat similar fashion quite a

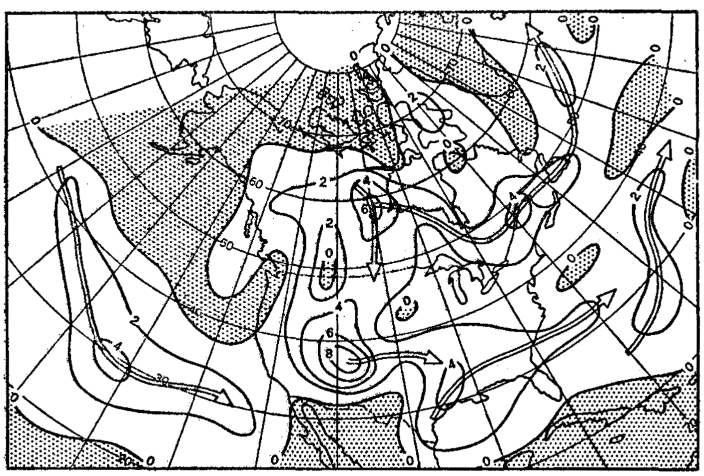

FIGURE 5.—Geographic frequency of anticyclonic passages (within approximately five-degree squares). December 1952. Well-defined tracks are indicated by solid arrows. Features of interest include numerous anticyclones in the Great Basin and lack of anticyclonic activity in the mountains of western Canada. Data derived from chart IX.

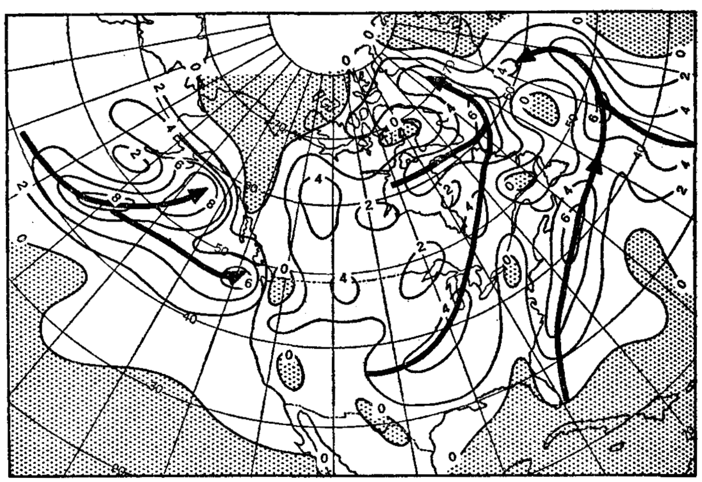

FIGURE 6.—Geographic distribution of cyclonic passages (within approximate five-degree squares) December 1952. Note activity in Gulf of Alaska and well defined central United States and East Coast storm tracks. Effects of blocking are apparent in eccentricities of Atlantic trajectories. All data derived from chart X.

few of the Atlantic coastal storms [2] were secondary developments of primary disturbances in the Lake region. Those cyclonic developments in the central United States accounted for near to above-normal precipitation in the Mississippi Valley and southern and central Great Plains (chart III–B). The coastal storms caused above-normal precipitation over most of New England and the eastern Middle Atlantic States.

Above-normal precipitation was also recorded in the Far West. It was associated with the mean 700-mb. trough at low latitudes and the maximum cyclonic curvature at higher latitudes of the United States. The daily synoptic counterparts related to these features were numerous frontal and 700-mb. troughs which spun from the Gulf of Alaska vortex and released copious amounts of precipitation as they entered the western United States. Below-normal precipitation was recorded in a broad band from Montana through Minnesota south-southwestward to western Texas, New Mexico, and Arizona. The deficiency in northern sections may be associated with foehn drying of prevailing northwesterly winds to the east of the mean ridge. At lower latitudes the persistent sea level anticyclone over the eastern Great Basin, and its eastern extensions, precluded cyclonic activity of significance.

WEATHER HIGHLIGHTS

Despite the relatively mild aspects of the December averages, this month as usual had its vagaries. Toward the end of its first week wind, rain, and snow struck northern California taking 5 lives and stranding 7 passenger trains. Less spectacular but possibly even more impressive was the fog which gripped the Central and South Atlantic Coast on the 6th and 7th, causing numerous transportation delays. London suffered the worst fog in years at almost the same time. It persisted for 4 days and was held responsible for an increase of 2,800 in the total number of London deaths noted the week ending December 13. A shorter-lived but intense recurrence of fog affected London again on the 26th.

The central United States storms created near-blizzard conditions over the Plains at times and several of the coastal storms spread quantities of snow over New England. Inclemency affected even Florida when a high-pressure area moving eastward from the southern Mississippi Valley spread frost as far south as the Everglades, and 26° F. was recorded at Tallahassee on the 12th.

[2] See adjacent article by Brown and Roe for a detailed description of one of these coastal storms.

REFERENCES

1. H. F. Hawkins, Jr., "The Weather and Circulation of November 1952, A Pronounced Reversal from October," *Monthly Weather Review*, vol. 80, No. 11, November 1952, pp. 220–226.
2. "Anomalies in the Northern Hemisphere 700-mb. Five-day Mean Circulation Patterns," (to be published as Air Weather Service *Technical Report No.* 105–100, 1953).
3. J. Namias and P. F. Clapp, "Confluence Theory of the High Tropospheric Jet Stream," *Journal of Meteorology*, vol. 6, No. 5, October 1949, pp. 330–336.

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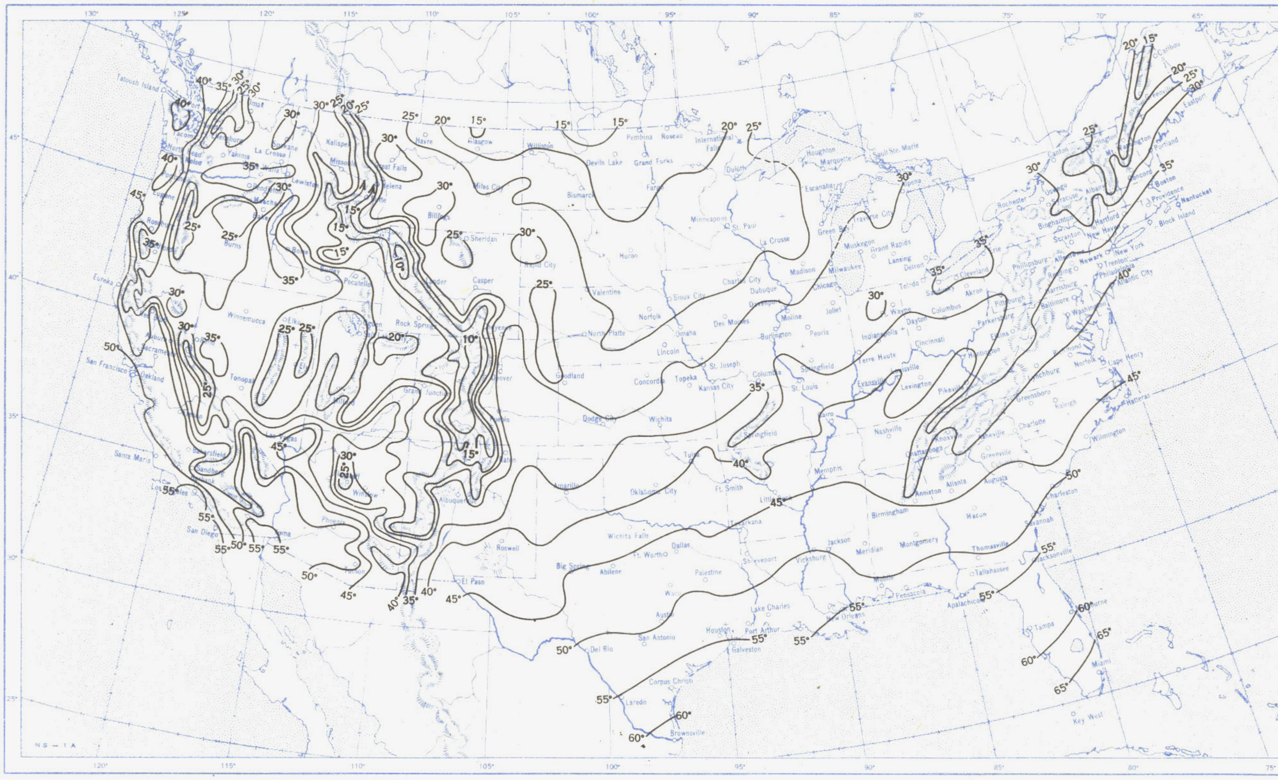
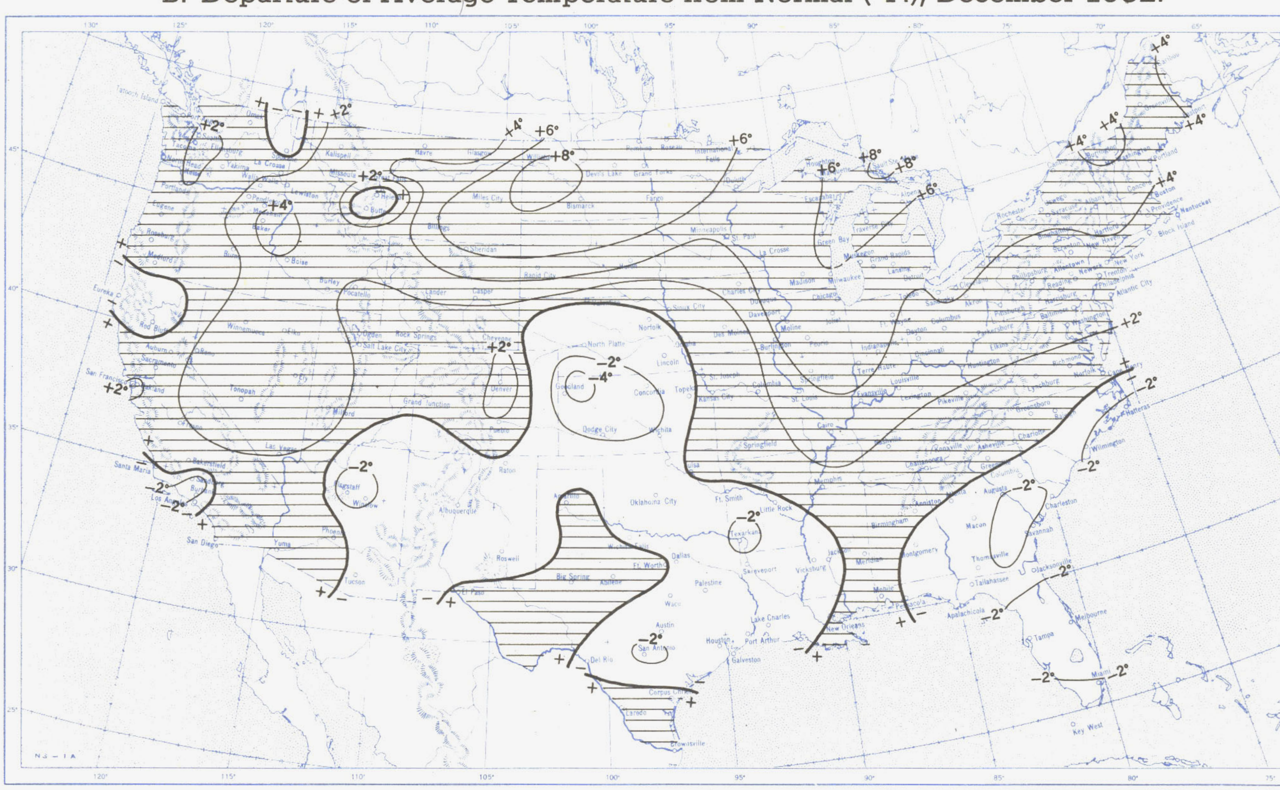
Chart I. A. Average Temperature (°F.) at Surface, December 1952.

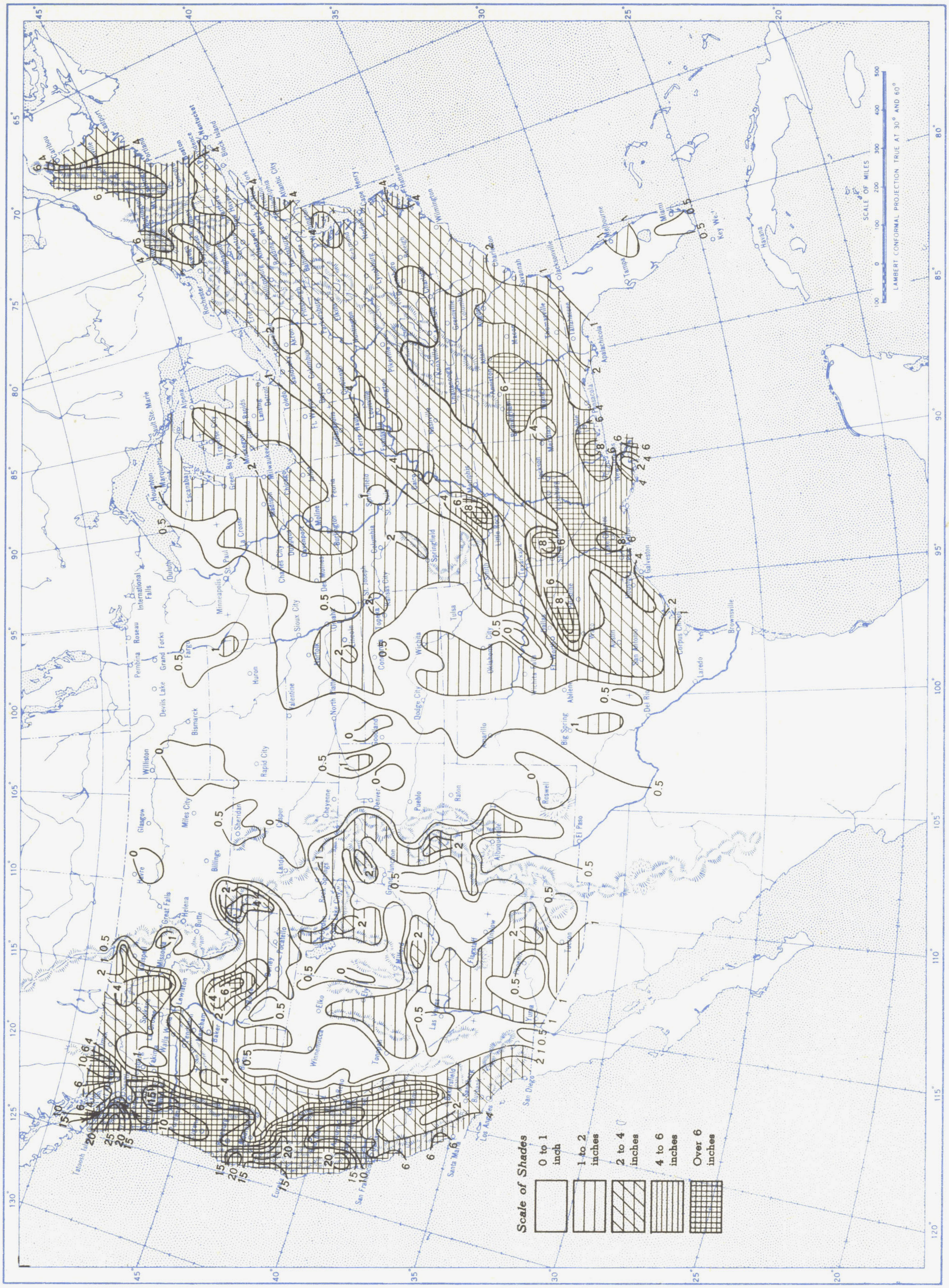


B. Departure of Average Temperature from Normal (°F.), December 1952.



A. Based on reports from 800 Weather Bureau and cooperative stations. The monthly average is half the sum of the monthly average maximum and monthly average minimum, which are the average of the daily maxima and daily minima, respectively.
B. Normal average monthly temperatures are computed for Weather Bureau stations having at least 10 years of record.

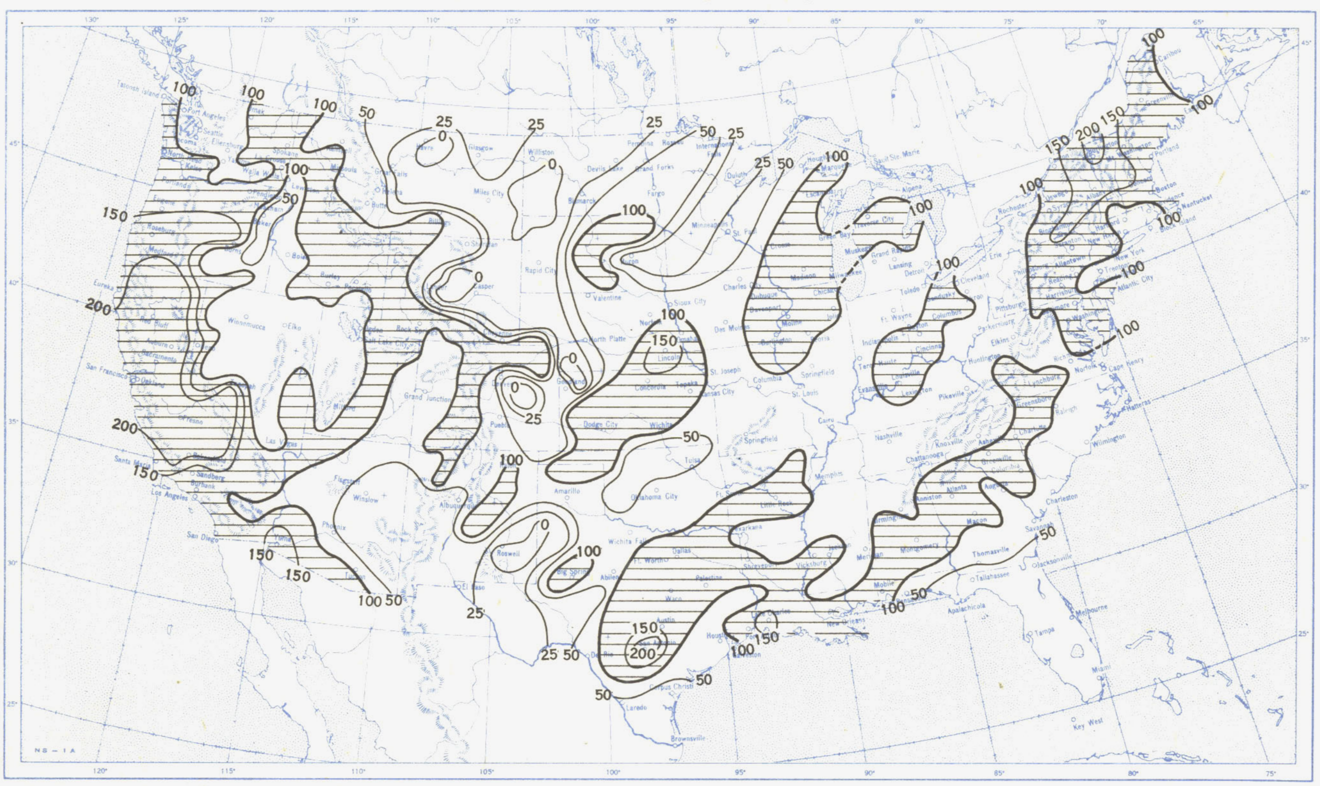
Chart II. Total Precipitation (Inches), December 1952.



Based on daily precipitation records at 800 Weather Bureau and cooperative stations.

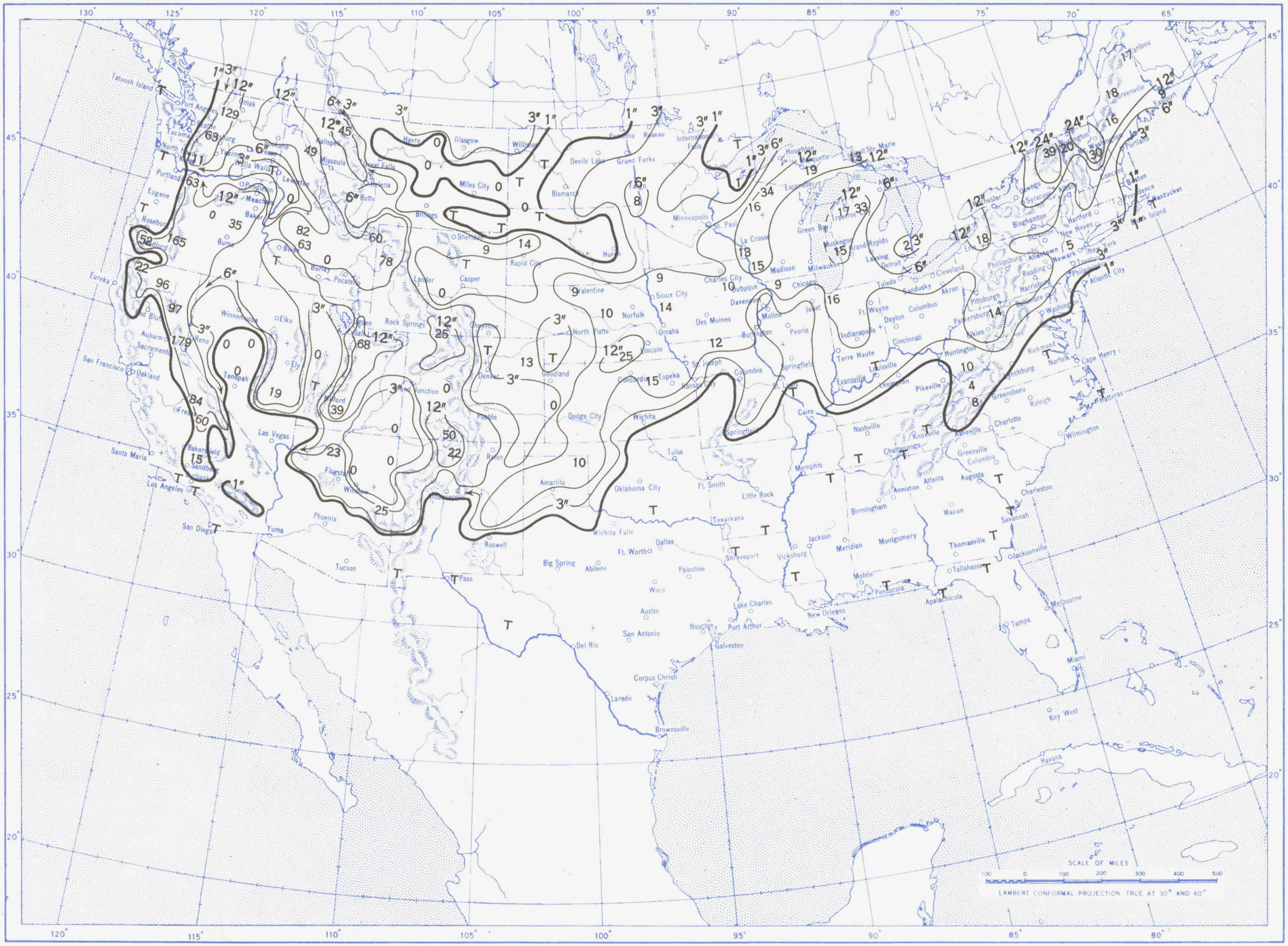
Chart III. A. Departure of Precipitation from Normal (Inches), December 1952.

B. Percentage of Normal Precipitation, December 1952.



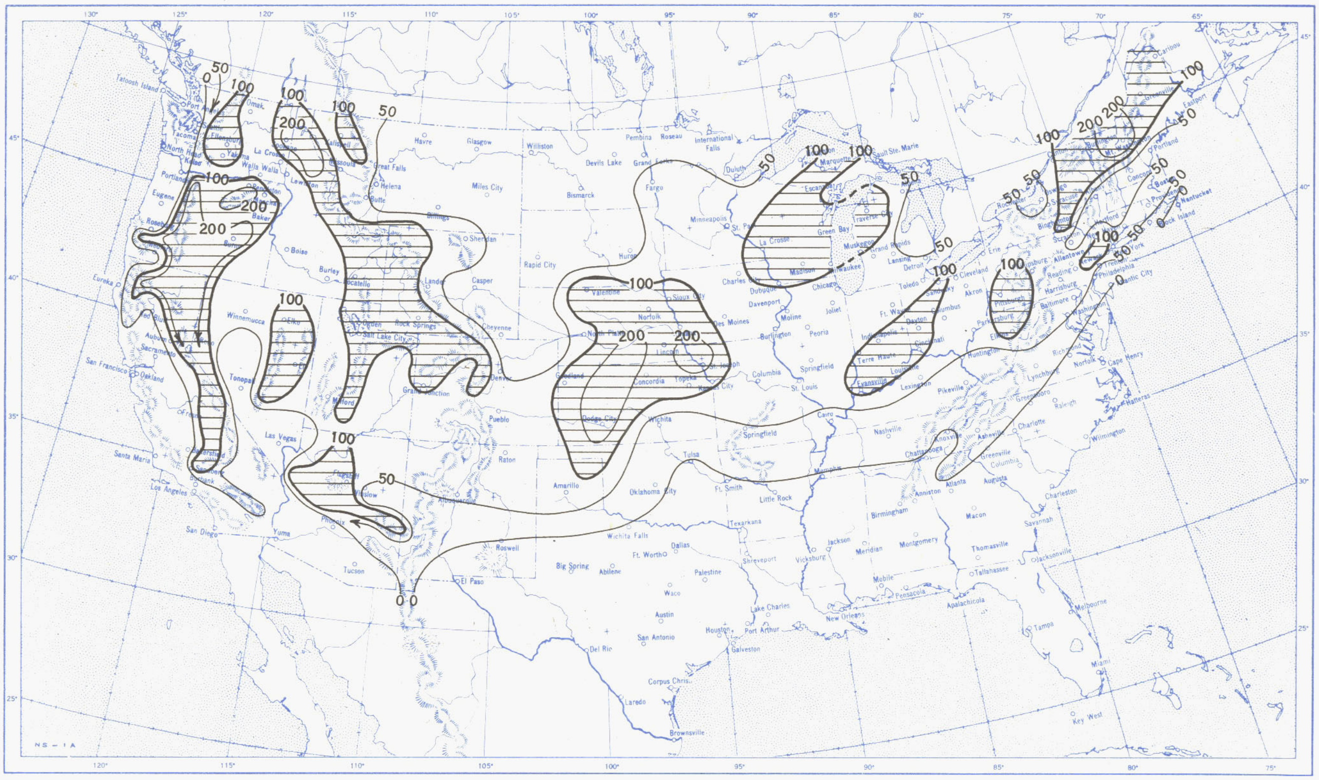
Normal monthly precipitation amounts are computed for stations having at least 10 years of record.

Chart IV. Total Snowfall (Inches), December 1952.

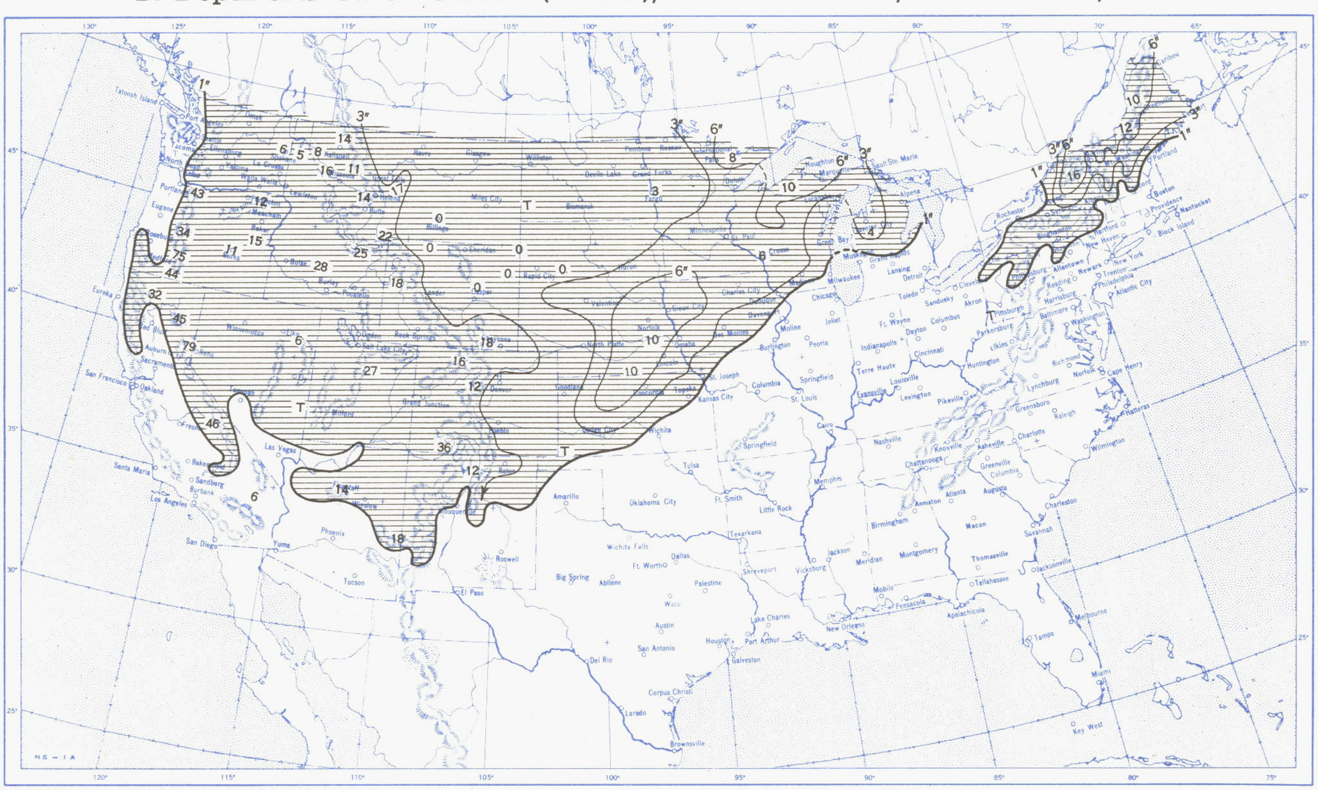


This is the total of unmelted snowfall recorded during the month at Weather Bureau and cooperative stations. This chart and Chart V are published only for the months of November through April although of course there is some snow at higher elevations, particularly in the far West, earlier and later in the year.

Chart V. A. Percentage of Normal Snowfall, December 1952.

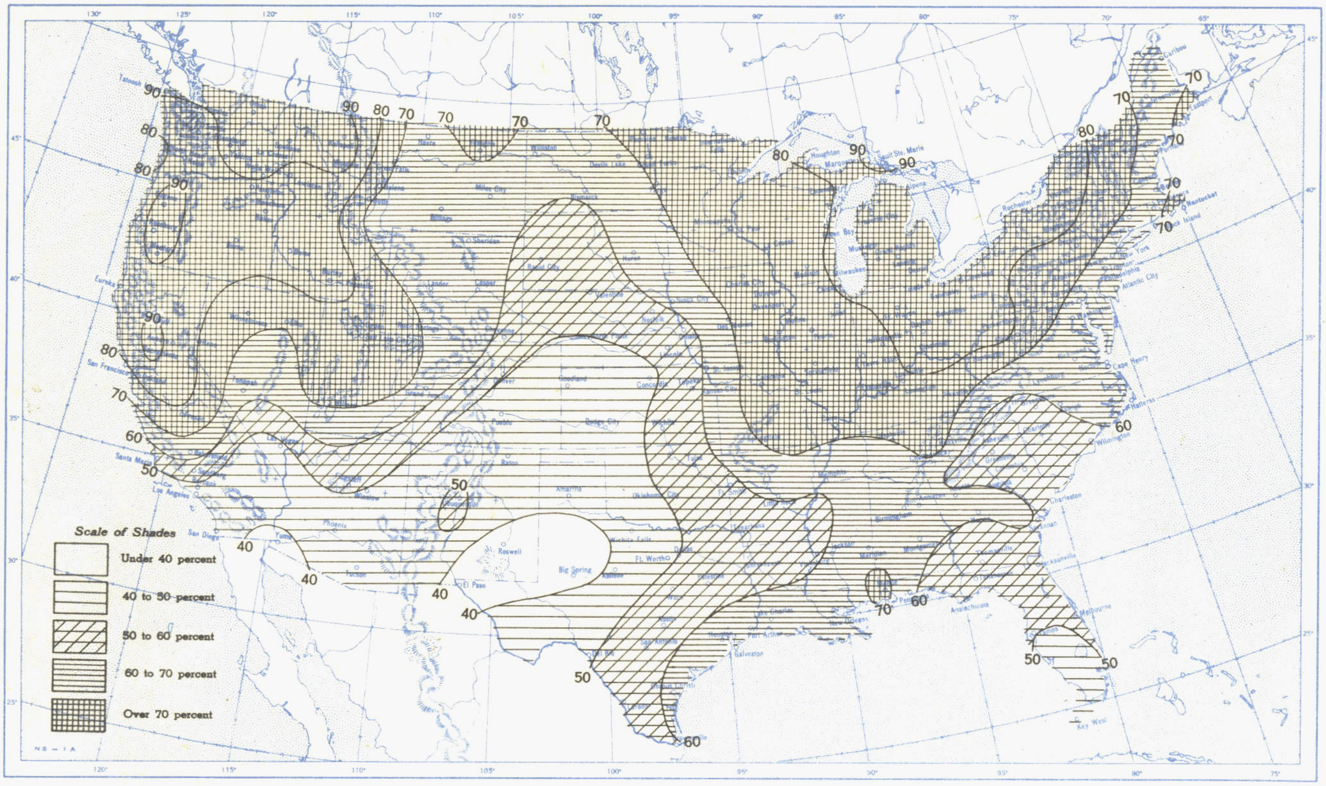


B. Depth of Snow on Ground (Inches), 7:30 a. m. E. S. T., December 30, 1952.

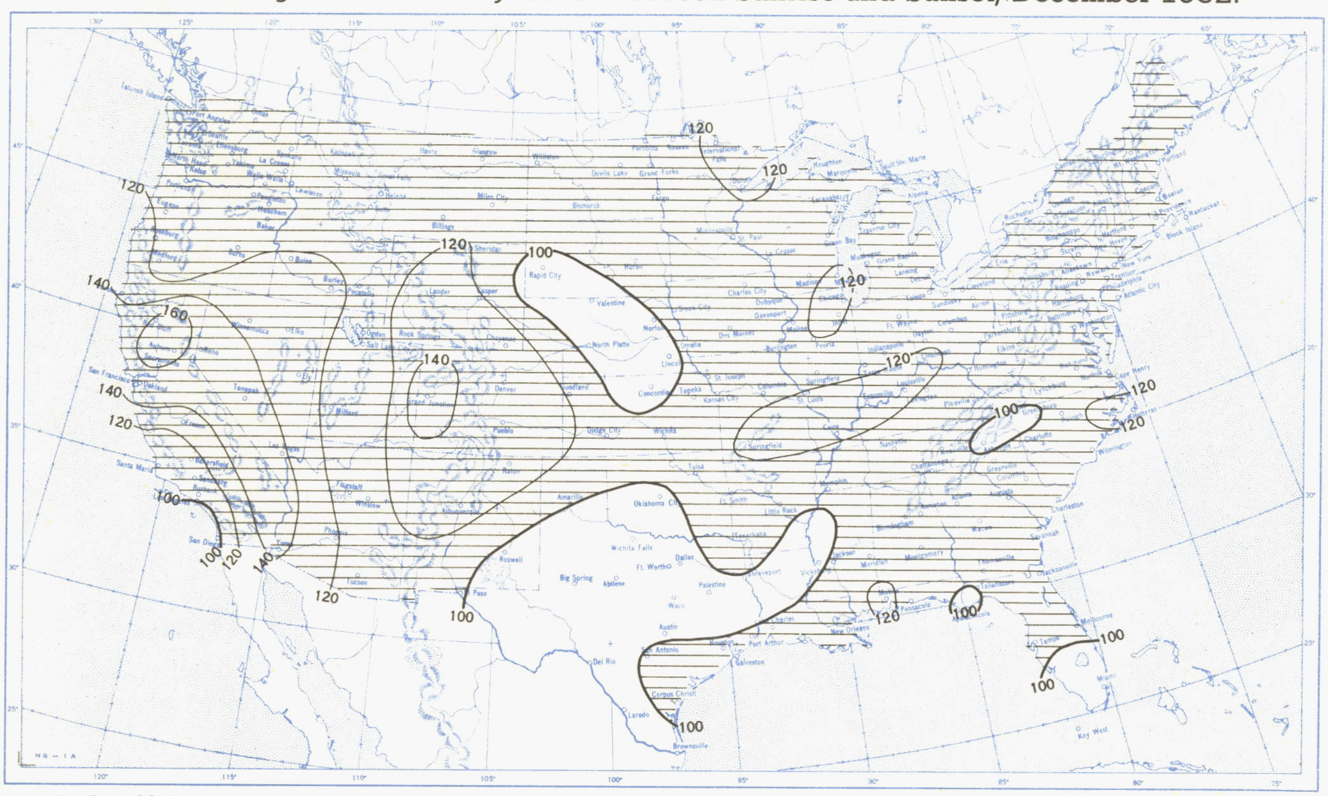


A. Amount of normal monthly snowfall is computed for Weather Bureau stations having at least 10 years of record.
B. Shows depth currently on ground at 7:30 a. m. E. S. T., of the Tuesday nearest the end of the month. It is based on reports from Weather Bureau and cooperative stations. Dashed line shows greatest southern extent of snowcover during month.

Chart VI. A. Percentage of Sky Cover Between Sunrise and Sunset, December 1952.

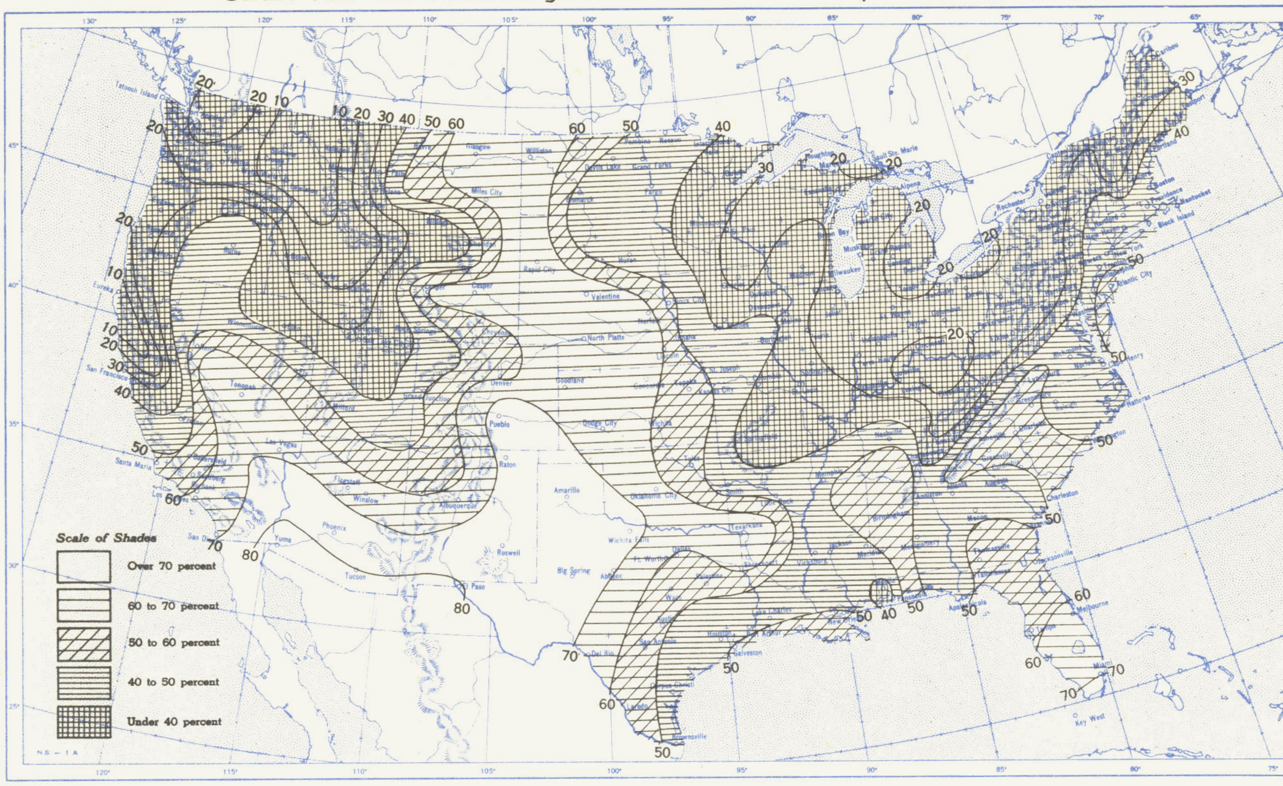


B. Percentage of Normal Sky Cover Between Sunrise and Sunset, December 1952.

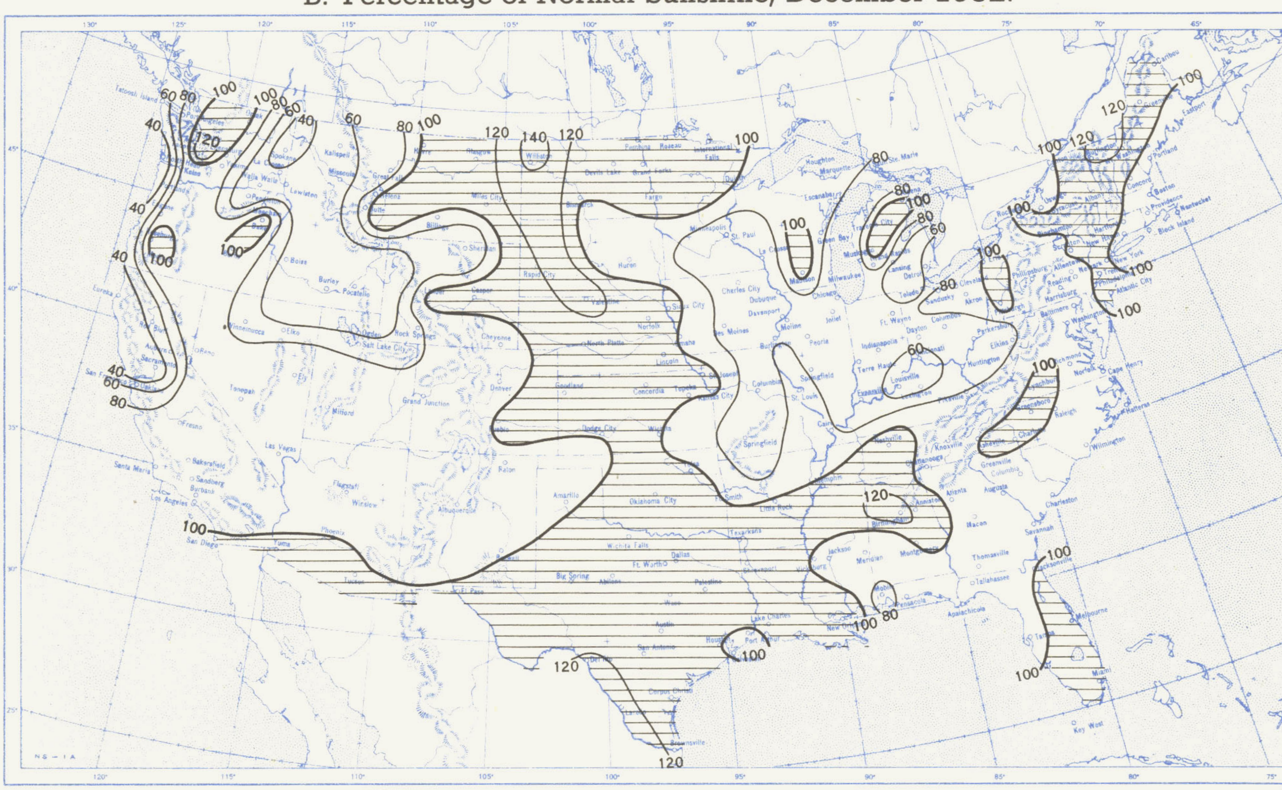


A. In addition to cloudiness, sky cover includes obscuration of the sky by fog, smoke, snow, etc. Chart based on visual observations made hourly at Weather Bureau stations and averaged over the month. B. Computations of normal amount of sky cover are made for stations having at least 10 years of record.

Chart VII. A. Percentage of Possible Sunshine, December 1952.



B. Percentage of Normal Sunshine, December 1952.



A. Computed from total number of hours of observed sunshine in relation to total number of possible hours of sunshine during month. B. Normals are computed for stations having at least 10 years of record.

Chart VIII. Average Daily Values of Solar Radiation, Direct + Diffuse, December 1952. Inset: Percentage of Normal Average Daily Solar Radiation, December 1952.

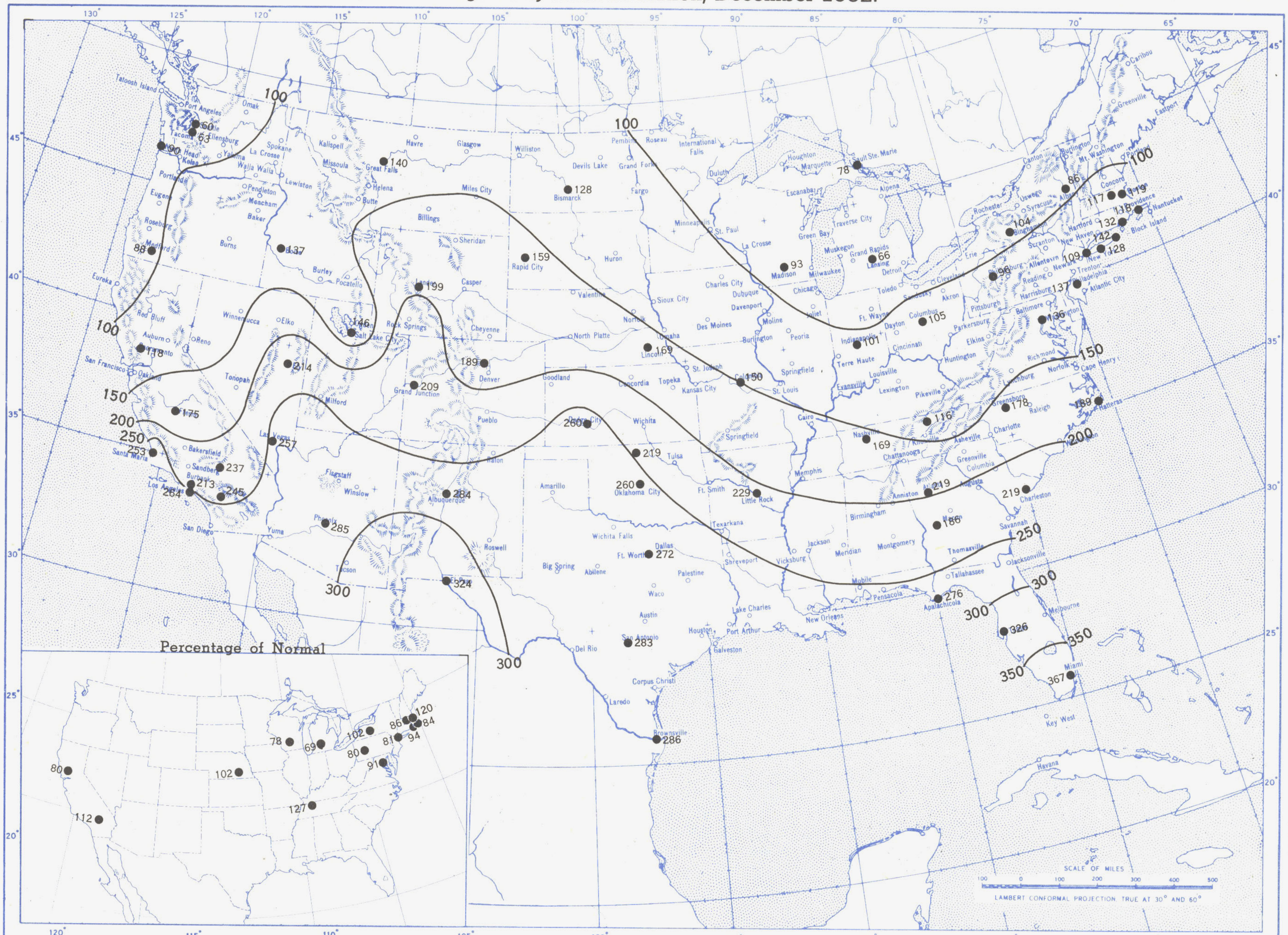
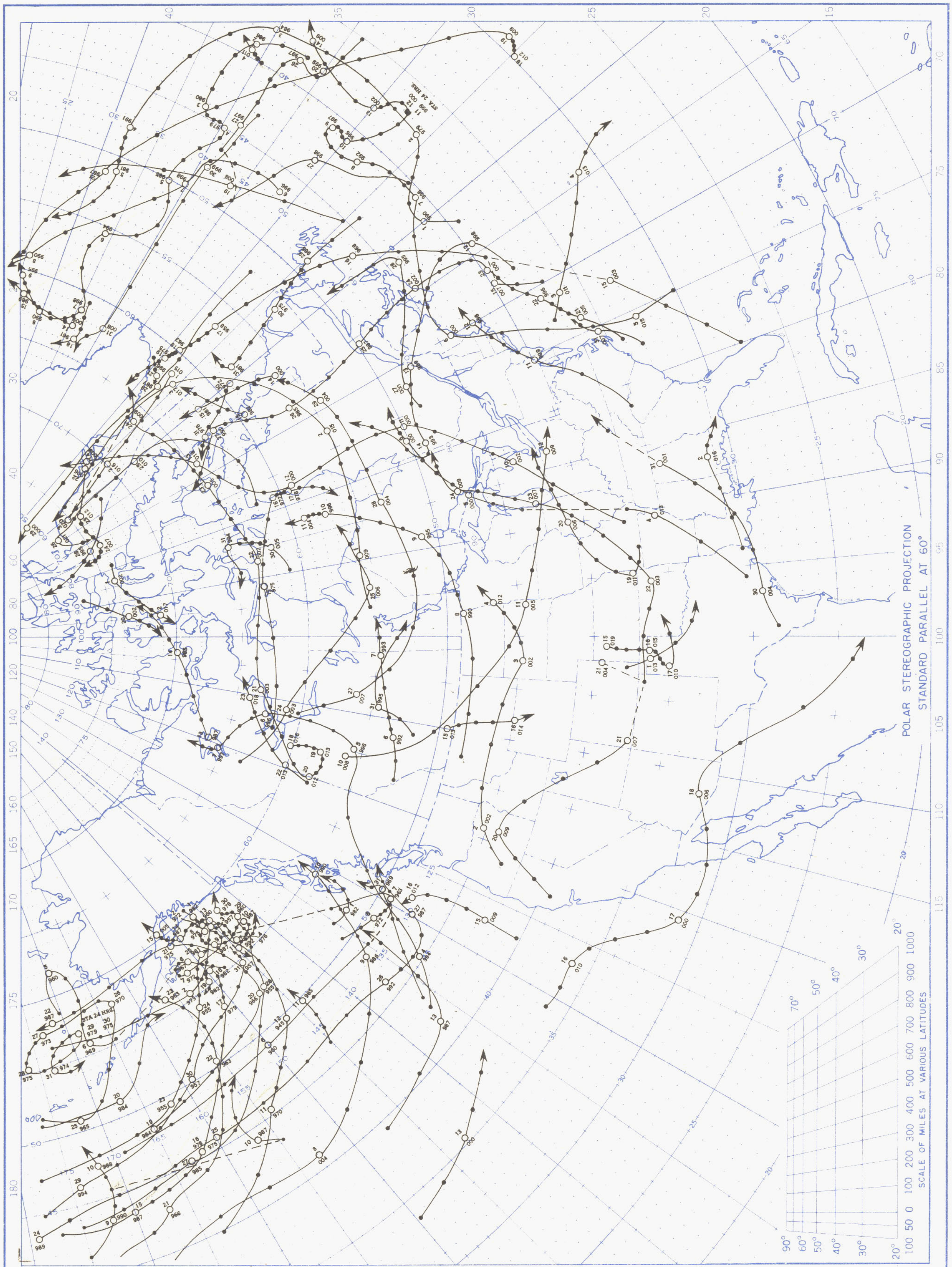


Chart shows mean daily solar radiation, direct + diffuse, received on a horizontal surface in langleys (1 langley = 1 gm. cal. cm. $^{-2}$). Basic data for isolines are shown on chart. Further estimates are obtained from supplementary data for which limits of accuracy are wider than for those data shown. Normals are computed for stations having at least 9 years of record.

Chart IX. Tracks of Centers of Anticyclones at Sea Level, December 1952.

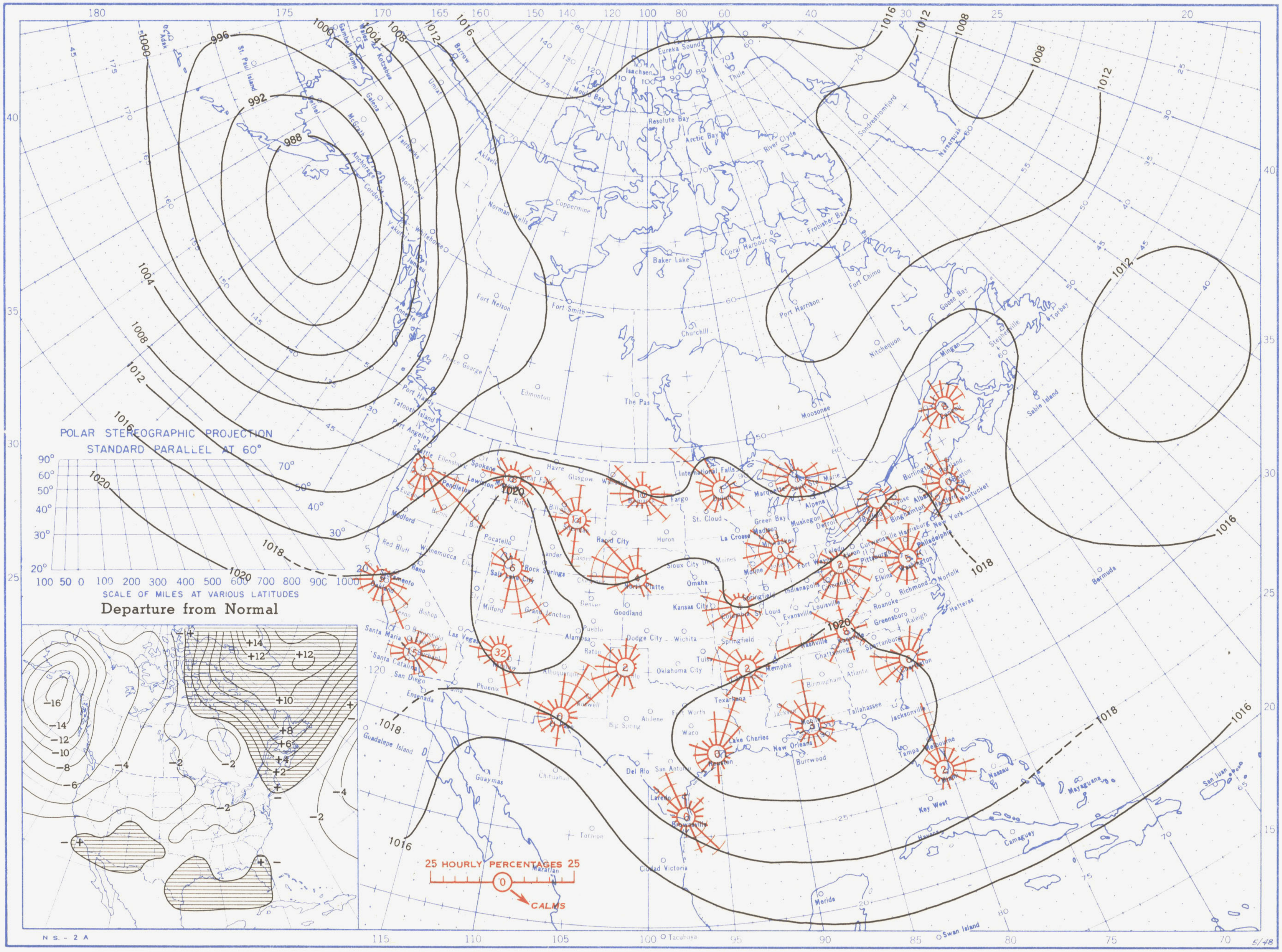
Circle indicates position of center at 7:30 a. m. E. S. T. Figure above circle indicates date, figure below, pressure to nearest millibar. Dots indicate intervening 6-hourly positions. Squares indicate position of stationary center for period shown. Dashed line in track indicates reformation at new position. Only those centers which could be identified for 24 hours or more are included.

Chart X. Tracks of Centers of Cyclones at Sea Level, December 1952.



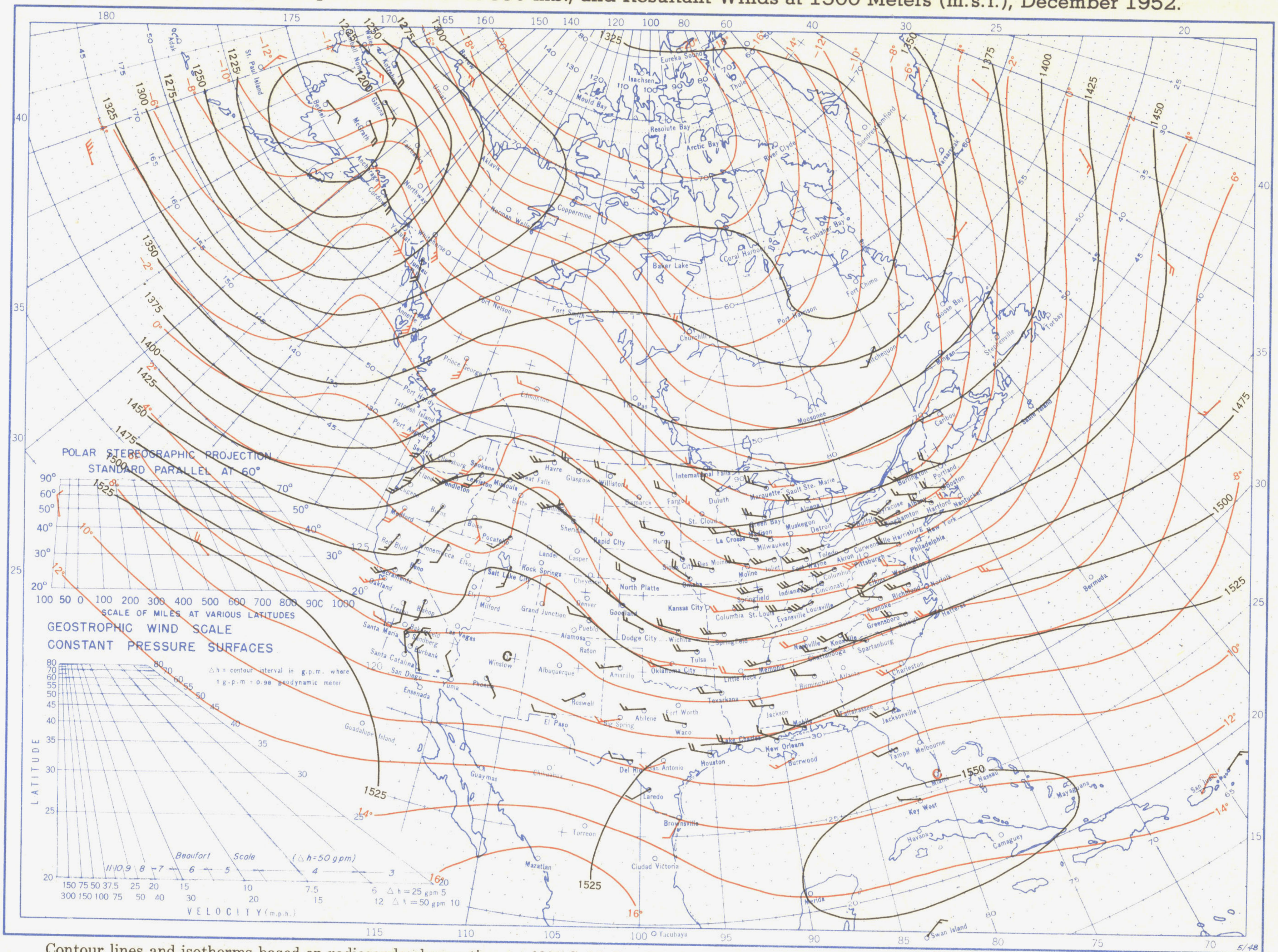
Circle indicates position of center at 7:30 a. m. E. S. T. See Chart IX for explanation of symbols.

Chart XI. Average Sea Level Pressure (mb.) and Surface Windroses, December 1952. Inset: Departure of Average Pressure (mb.) from Normal, December 1952.



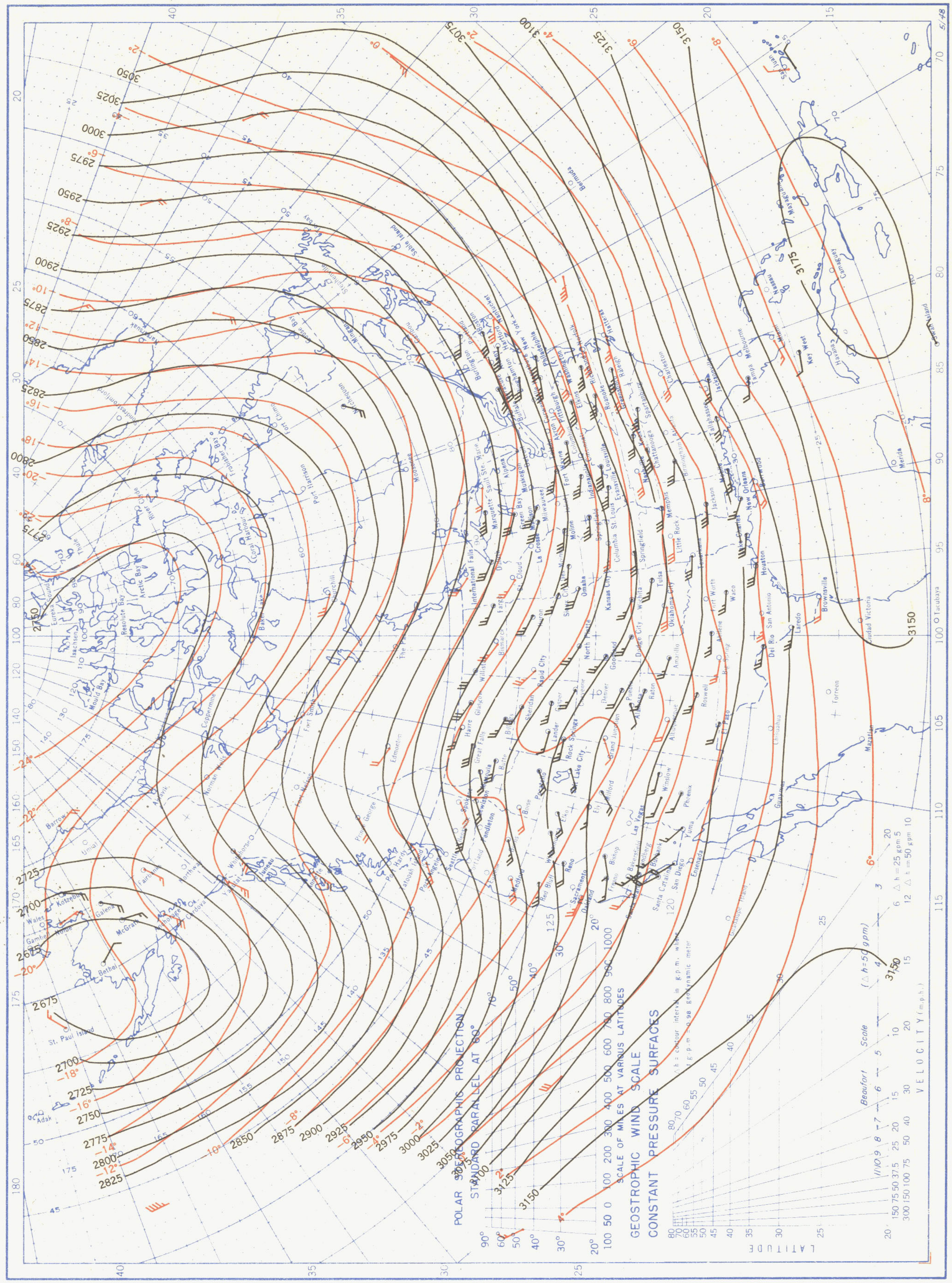
Average sea level pressures are obtained from the averages of the 7:30 a. m. and 7:30 p. m. E. S. T. readings. Windroses show percentage of time wind blew from 16 compass points or was calm during the month. Pressure normals are computed for stations having at least 10 years of record and for 10° intersections in a diamond grid based on readings from the Historical Weather Maps (1899-1939) for the 20 years of most complete data coverage prior to 1940.

Chart XII. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 850-mb. Pressure Surface, Average Temperature in °C. at 850 mb., and Resultant Winds at 1500 Meters (m.s.l.), December 1952.



Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins taken at 0300 G. M. T.

Chart XIII. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 700-mb. Pressure Surface, Average Temperature in °C. at 700 mb., and Resultant Winds at 3000 Meters (m.s.l.), December 1952.



Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins taken at 0300 G. M. T.

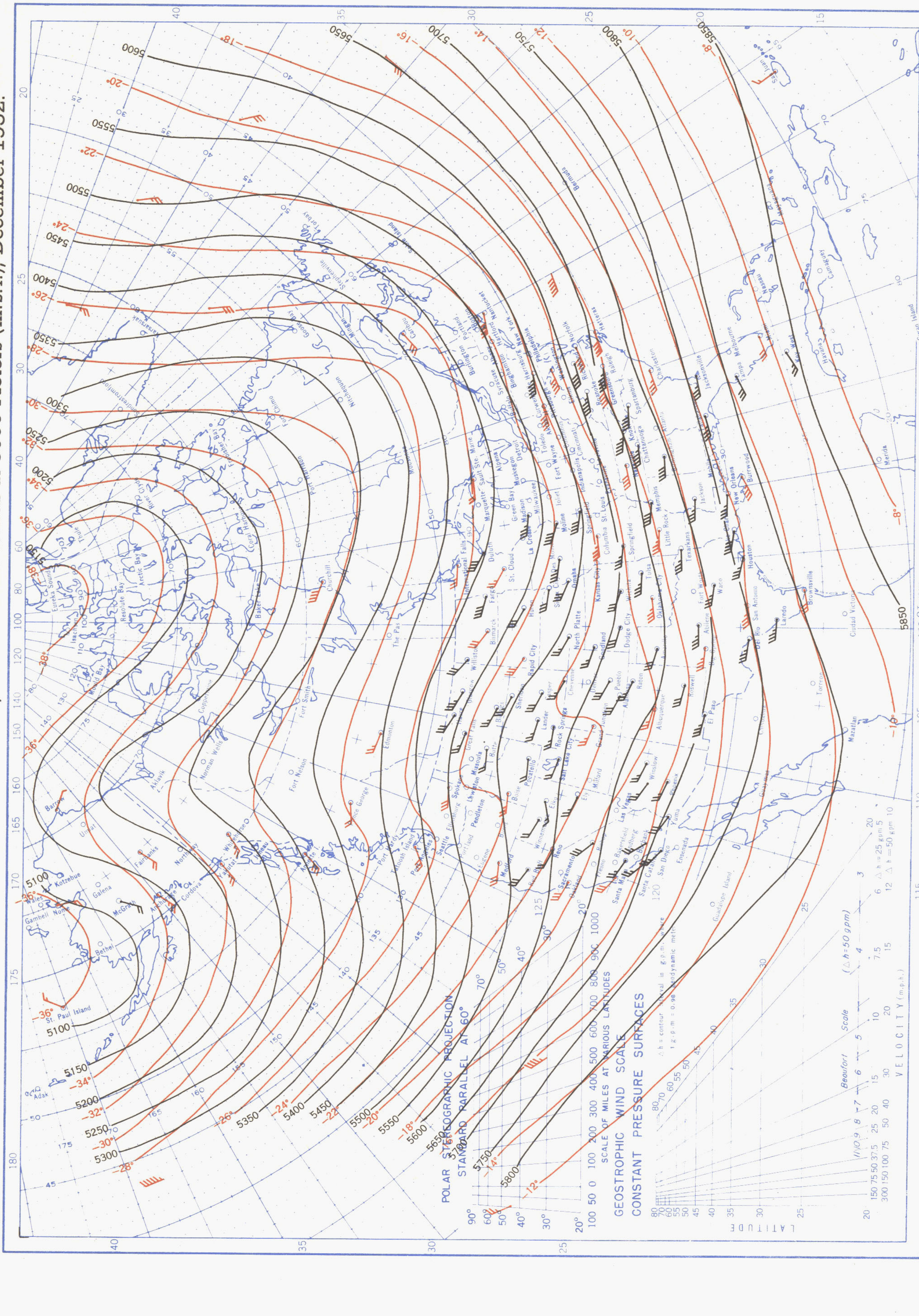
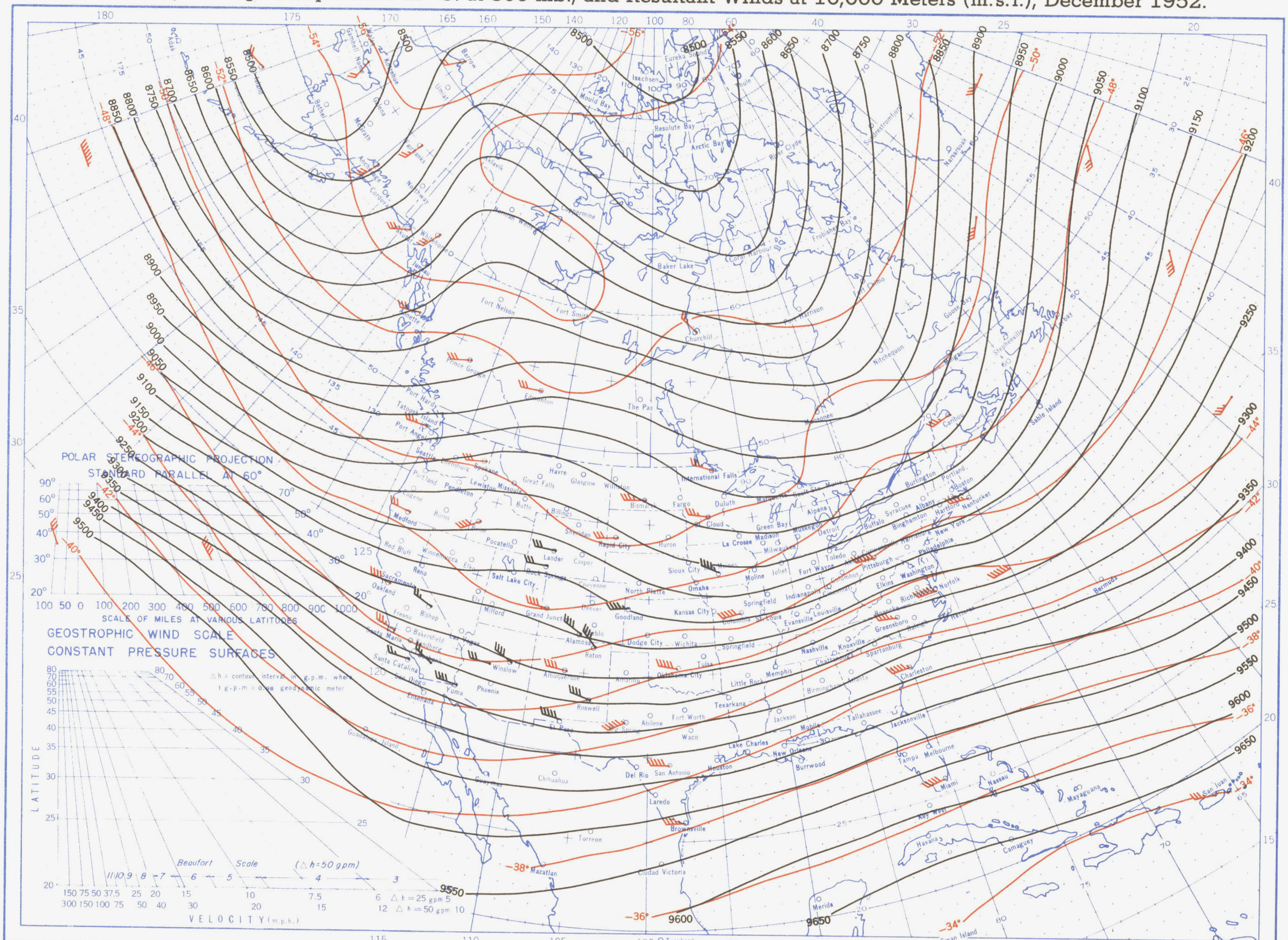


Chart XIV. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 500-mb. Pressure Surface, Average Temperature in °C. at 500 mb., and Resultant Winds at 5000 Meters (m.s.l.), December 1952.

Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins at 0300 G. M. T.

Chart XV. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 300-mb. Pressure Surface, Average Temperature in °C. at 300 mb., and Resultant Winds at 10,000 Meters (m.s.l.), December 1952.



Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins at 0300 G. M. T.